Small Business Innovation Research/Small Business Tech Transfer

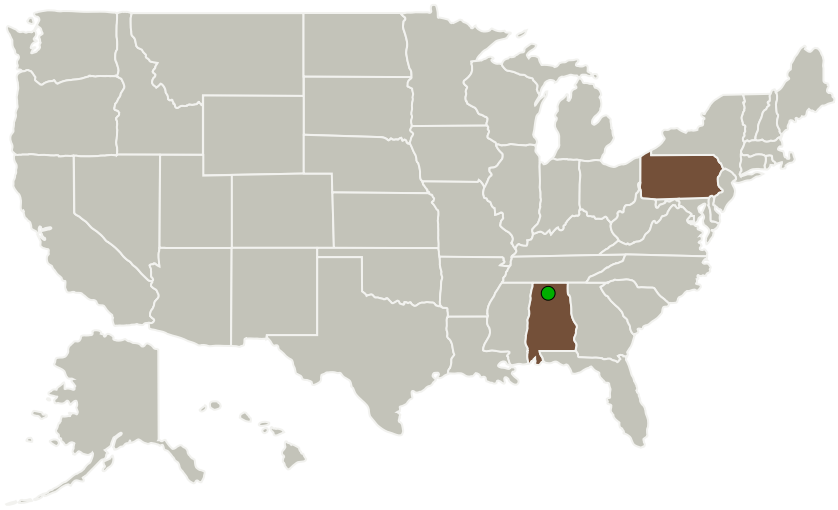
Loop Heat Pipe Manufacturing via DMLS for CubeSAT Applications, Phase I

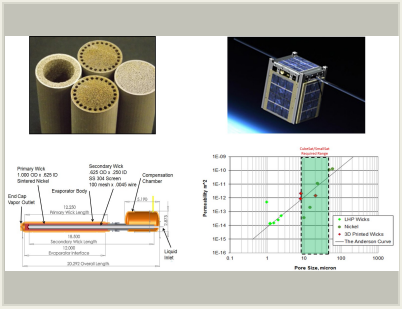
Completed Technology Project (2016 - 2016)

Project Introduction

Advanced Cooling Technologies, Inc. (ACT) proposes to develop a low-cost Loop Heat Pipe (LHP) evaporator using a technique known as Direct Metal Laser Sintering (DMLS), otherwise known as 3D printing, to produce low-cost LHPs to be used in CubeSat and SmallSat applications. The wick structure in an LHP assumes the role of a pump in a standard loop, pumping liquid from the lower pressure condenser to the higher pressure evaporator by capillary forces. The overall thermal performance of the system is therefore highly dependent on the in-situ characteristics of the wick structure. Current LHP wick manufacturing and installation processes are cumbersome, labor intensive, and suffer from a low yield rate. Specifically, the primary wick's hydrodynamic characteristics and sealing integrity to the envelope are critical to heat transport, start-up, shut down and overall reliability. It is estimated that the cost to produce an LHP evaporator, including the attachment of the bayonet, secondary wick and compensation chamber, accounts for approximately 75% of the total system's manufacturing cost. By 3D printing an evaporator envelope with an integral porous primary wick structure, the overall complexity and cost of the design can be significantly reduced.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Pennsylvania

Project Transitions

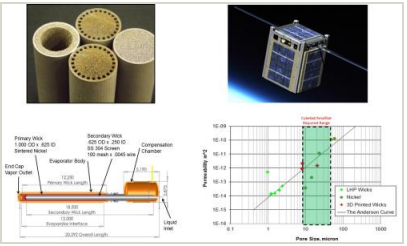
June 2016: Project Start

December 2016: Closed out

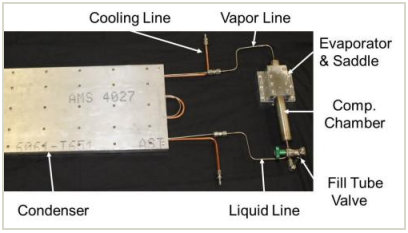
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139700)*

Images



Briefing Chart Image
Loop Heat Pipe Manufacturing via DMLS for CubeSAT Applications, Phase I *(https://techport.nasa.gov/image/135508)*



Final Summary Chart Image
Loop Heat Pipe Manufacturing via DMLS for CubeSAT Applications, Phase I Project Image *(https://techport.nasa.gov/image/131119)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Advanced Cooling Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

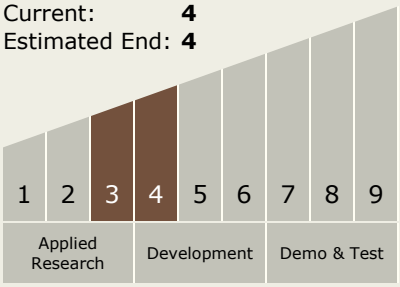
Carlos Torrez

Principal Investigator:

William Anderson

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.2 Heat Transport

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System